themselves to a qualification test, is in order that these offices may not be the refuge for genteel incompetence, but may be bestowed on the most fitting aspirant. We fear the above facts will show that the present system is not calculated in all cases to secure this end.

## THE GIBRALTAR CURRENT

MR. CROLL having stated (NATURE, August 17) that, taking my own data, and having "in regard to the Gibraltar current and Dr. C.'s general oceanic circulation, determined the absolute amount of those effects on which his circulation depends," he has satisfied himself by mathematical investigation "that the work of the resistances greatly exceeds the work of gravity, and that consequently there can be no such circulation as that for which Dr. C. contends,"—I think it well to point out that the question of the existence of such a circulation is not to be disposed of by the calculations of even such an expert computer as Mr. Croll, but must be decided by the collection and comparison of facts ascertained by observation and experiment.

Now, as it happens that an opportunity has been recently afforded me by the Hydrographer to the Admiralty of carrying out, in conjunction with Captain Nares, of H.M.S. *Shearwater*, a series of further researches on the Gibraltar current, which place beyond all doubt the outflow of dense Mediterranean water into the Atlantic, over the "ridge" or "marine watershed" between Capes Trafalgar and Spartel, and beneath the surface-inflow of Atlantic water, I would submit (1) whether there must not be some fundamental fallacy in Mr. Croll's computations in regard to the Gibraltar current, and (2) whether this fallacy should not destroy all confidence in the infallibility with which Mr. Croll credits himself in regard to the general oceanic circulation.

No one can be more ready than myself to admit that this last doctrine is at present only a hypothesis, resting on a very narrow basis of fact. But as this hypothesis has been accepted as probable by such great masters in physical science as Sir John Herschel and Sir William Thomson, and as the means of putting it to the test will be supplied by the Scientific Circumnavigation Expedition, which (I have every reason to expect) will be fitted out by Her Majesty's Government next year, I would venture to suggest whether prudence does not dictate to the opponents of that doctrine, that they should either drop further discussion of it for the present, or that at any rate they should refrain from attempting to demonstrate its impossibility.

The number of NATURE which contained Mr. Croll's letter, having also given an account of the discussion which took place in the Physical Section of the British Association on a communication I made to it with reference to this subject, I may mention that my especial purpose in that communication was to obtain the judgment of the able physicists there assembled, as to a fundamental question at issue between my friend, Prof. Wyville Thomson, and myself, namely, the *cause* of that flow of polar water over the deepest parts of the ocean bottom, bringing down its temperature even under the equator to 33°·5, as to the fact of which we are in entire agreement. By my excellent colleague it is considered* that this flow is due to an indraught of polar water, occasioned by the surface efflux of equatorial water resulting from the action of the Trade Winds. To myself (not professing more than an elementary knowledge of physics) it seemed probable, on the principle of "least action," that the surface-water so removed would be replaced by an inflow from some other part of the oceanic surface, that is, by a horizontal circulation, rather than by an uprising of the whole subjacent mass, so as to draw in polar water at the bottom, and I have pointed out that such a surface-replacement is known to take place in the case of the Gulf Stream, one portion of which directly returns into the equatorial current, completing the shorter circulation, whilst the other has its complement in the Greenland, Labrador, and other polar surface-currents, of which the principal is traceable southwards nearly as far as the exit of the Gulf Stream from the Narrows, thus completing the longer circulation.

The correctness of this "common-sense" judgment was most emphatically affirmed, on the basis of profound physical knowledge, by Sir William Thomson and Prof. Stokes. It was agreed by these high authorities that in the open ocean the action of wind on the surface can never produce any other than a surface movement; the water propelled onwards from one part of the oceanic area being replaced by a surface inflow from other parts It is, therefore, for my opponents to explain how, otherwise than by gravity, it happens that polar water finds itself at the depth of 2,000 fathoms under the equator. That the bottom-temperature of the equatorial area, if there were no movement of polar water towards the equator, would be at least 20° higher than it is, may be asserted without the least hesitation; the temperature of the Mediterranean, which is cut off from communication with the lower stratum of the Atlantic, being 54° at corresponding depths.

It was agreed by Sir William Thomson and Prof. Stokes, that when a wind blows continuously into a loch or fiord, so as to produce a rise of water at its head to the amount of 6, 8, or 10 feet, such an excess or vertical pressure produces an outward under-current; the evidence of such outflow being afforded by the continuance of the surface in-current at the rate of three or four miles per hour, without any further increase in the rise of water at the head of the loch. This exceptional case was advanced by Sir W. Thomson as strongly confirming my general principle, not as invalidating it; and I would therefore recommend Mr. Croll to test his method of investigation by this ascertained fact, rather than spend his time in demonstrating the impossibility of what he may hereafter have to admit as no less certainly proved.

WILLIAM B. CARPENTER

H.M.S. *Shearwater*, Malta,
Sept. 20

*See his Address on "The Distribution of Temperature in the North Atlantic," NATURE, July 27.

## SCIENCE IN ITALY

IN NATURE for June 8, I sketched a short notice of some of the Italian scientific serials, among them the *Annali di Chimica Applicata alla Medicina*, published at Milan. With the commencement of the present year the *Gazetta Chimica Italiana* has been launched at Palermo. The project of this publication originated in Florence with a society of Italian chemists, who met there in October last, and resolved to entrust the first year's "direction" of the magazine to Prof. Stanilaus Cannizzaro of the University of Palermo.

The Italian Chemical Gazette very nearly resembles the *Journal of the Chemical Society of London*. Like this it contains, first, original memoirs; second, translations or abstracts of the most important foreign chemical memoirs; third, a review of technological chemistry, agricultural chemistry, and crystallography; fourth, a summary of the principal chemical journals of Germany, England, and France; fifth, miscellaneous notes that may be interesting to those who cultivate chemical science. It is published monthly.

The most prominent, the longest, and most interesting of the original papers is by Prof. Cannizzaro: "Historical notes and reflections on the Application of the Atomic Theory to Chemistry, and on the Systems of Formulæ for expressing the Constitution of Compounds." This paper is continued in the number for January, April, and May,